

## Technical note

### NANO 3 PHASE CT

**Abstract:** With the advent of smart technologies, digital metering has gained popularity in the field of measurement & control. It becomes unnecessary to use large current inputs for digital meters and in order to reduce size and cost, CTs with compact size and low output current ratings in the range of milliamperes (mA) are manufactured. These are called nano CTs due to their compact appearance and mA output, making them most suitable for modular panel applications.

## Introduction

### Current transformers:

According to IEC 61869-2, A current transformer is in which the secondary current, under normal conditions of use, is substantially proportional to primary current and differs in phase from it by an angle which is approximately zero for an appropriate direction of the connections.

### Working principle:

Current transformers reduce high magnitude currents to a much lower value and provide a convenient way of safely monitoring the actual electrical current flowing in an AC circuit which is carrying high current with the help of an ammeter.

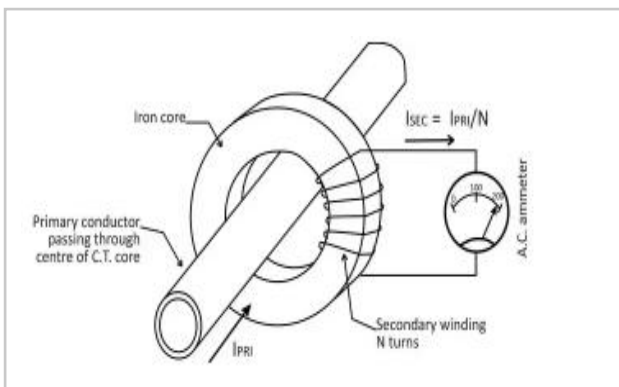


Fig.1.Construction & working of CT

The principle of operation of a basic current transformer is slightly different from that of an ordinary voltage transformer.

It consists of only one or very few turns as its primary winding. The primary winding can be of either a single flat turn, a coil of heavy duty wire wrapped around the core or just a conductor or bus bar placed through a central hole as shown. Due to this type of arrangement it is to be connected in series with the conductor carrying load.

A current transformer, like any other transformer, must satisfy the amp-turn equation and as we know this turns ratio is equal to:

$$\text{TurnsRatio} = n = \frac{N_P}{N_S} = \frac{I_S}{I_P}$$

Hence, secondary current ( $I_S$ ) is:

$$I_S = I_P \left( \frac{N_P}{N_S} \right)$$

For example, the current rating of the primary winding is 125A. The secondary winding has the standard rating of 5A. Then the ratio between the primary and the secondary currents is 125A to 5A, or 25:1. In other words, the primary current is 25 times greater than the secondary current.

Current transformers are used extensively for measuring current and monitoring the operation of the power grid & these monitoring circuits are generally rated for low input currents. Hence the secondary of a CT has a rated current of 1A or 5A.

Often, multiple CTs are installed for various uses. For example, protection devices and

revenue metering may use separate CTs to provide necessary current inputs to the respective systems. For isolation between metering and protection circuits current transformers with different characteristics (accuracy, overload performance) can be used.

### **Special Purpose Current Transformers:**

Generally the current transformers used have rated secondary of 5A or 1A. But due to the implementation of 'Smart Systems' like PLCs, Modular Control Panels, Branch Circuit Monitoring, Remote Terminal Units Power Distribution Units and control systems the requirement of special types of CTs becomes apparent.

Some of them are follows:

- ✓ Compact Split core CTs
- ✓ CT with integrated Transducer
- ✓ Multi-ratio unipolar transformer
- ✓ Three phase Nano CTs

The scope of this document will be only for 3 phase Nano CT.

### **Rish Nano CT:**

Current transformers finds its application in the field of measurement & protection such as Power Control Centers, Motor Control Centers, switch-gear and protection systems.

But due the increase in consumption of electrical energy and the widespread awareness of energy efficiency, there has been a boost in the implementation of monitoring and analyzing devices which include bulky high power consuming instrument transformers, increasing the system complexities regarding space, hard-wiring and fault detection.

The new innovative Nano 3-phase CT offers significant advantages to professionals during the power analysis and meter implementation and installation phase in

electrical panels, mitigating the aforementioned complications.



Fig.2. Rish Nano 3 phase CT

It is a set of three compact current transformers for 63A, 125A & 250A panels.

Being a very reliable, efficient and low power consuming device with a burden of 0.1VA and secondary output of 250mA, it can be used with contactors, measuring and control devices in modular control panels.

In control systems where accuracy is crucial, Nano CT can prove to be efficient as well as accurate with an accuracy class of 0.5 according to international standards IEC 61869-1 & IEC 61869-2.

Its secondary output is a 4 core cable with a diameter of 6mm; 550mm long for 63A & 125A and 1550mm for 250A current output. These lengths mentioned do not affect the accuracy of the CT. As well as leads to easy and safe electrical connections.

It is encapsulated in an IP20 covering which makes it safe for the wire-man, while making electrical connections.

In order to sustain high temperatures when mounted in a panel which is situated in oppressive hot areas, thermal class B insulation is used.

UL 94 V-0 approved Flame retardant, Self-extinguishing and Non-drip Polycarbonate material casing is used to safeguard in-case of fire hazards .

Here are some of the product features at a glance:

- ✧ Compact design, fully encapsulate
- ✧ UL 94 V-0 approved Polycarbonate material casing
- ✧ High electric isolation between primary conductor and output
- ✧ Easy and safe electrical connections
- ✧ Fully type tested as per IEC 61869-1 & 2.

### Areas of Application:

The compact and robust design with an output of 250mA makes Nano CT open for a number of applications.

#### 1] Motor Control Centers (MCC):

Motor control centers is an assembly which houses a combination of motor control units.

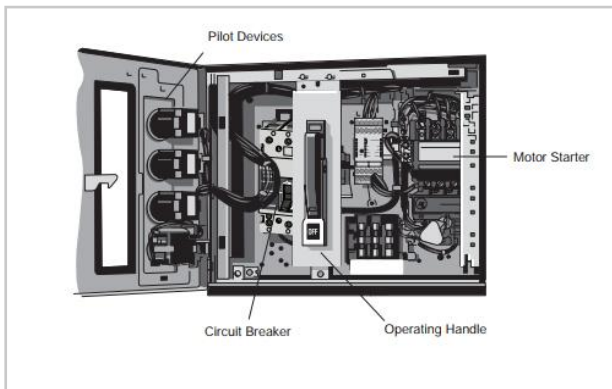


Fig. 3. Motor Control Center

These include switching & protection devices like thermal overload relays, circuit breakers

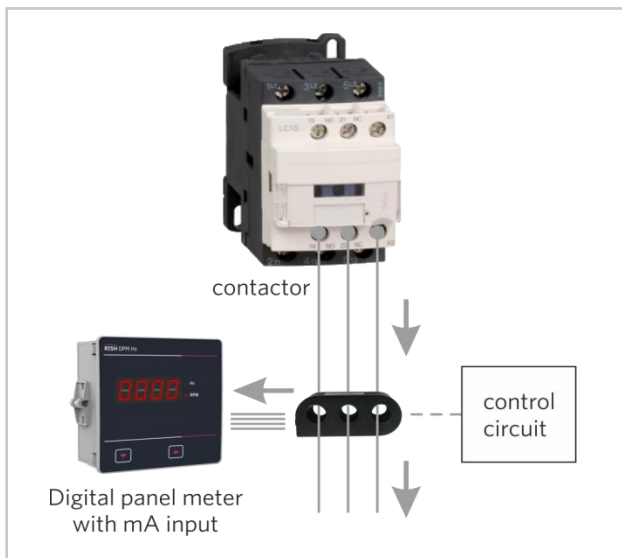


Fig. 4. Branch circuit monitoring

and motor starters and meters for current & voltage monitoring.

For 3 phase higher horse power motors, meters used are fed through CTs.

Nano CT can be used for the measuring & indication in MCC. This gives added benefits of :

- Proper space utilization
- Reduction in wiring harnesses
- Ease of installation
- Eliminates use of three different CTs

#### 2] Branch circuit monitoring:

Branch Circuit Monitoring (BCM) system allows us to fully utilize a power infrastructure and manage capacity as your data center grows and changes.

Different critical areas of a plant are monitored and their electrical parameters are displayed using digital panel meters.

Rish Nano 3 phase CT suit well for such applications. In this case the meters must be calibrated and tested for mA current inputs and display currents in Amperes.

The above mentioned features and technical details makes Rish Nano three-phase CT perfect for compact and modular applications.